Middle East Technical University | Department of Computer Engineering

CENG 222

Statistical Methods for Computer Engineering

Spring 2019-2020

Homework 3

Due date: 17 May 2020, Sunday, 23:55

Suggested Solutions

Q1.

$\hat{\theta} = \overline{X} - \overline{Y} = 3.375 - 2.05 = 1.325$
$\sigma(X) = 0.96$
$\sigma(Y) = 1.12$
$\sigma(\hat{\theta}) = \sqrt{\frac{0.96^2}{19} + \frac{1.12^2}{15}} = \sqrt{0.0485 + 0.0836} = \sqrt{0.1321}$

a)

$\alpha = 0.05$
$z_{\alpha/2} = 1.96$
Confidence interval: $1.325 \pm 1.96 \times \sqrt{0.132} \Rightarrow [0.61, 2.04]$.

b)

$\alpha = 0.1$
$z_{\alpha/2} = 1.645$
Confidence interval: $1.325 \pm 1.645 \times \sqrt{0.132} \Rightarrow [0.73, 1.92]$.

c)

$H_0 : \mu_x = 3$
$H_A : \mu_x > 3$
One-sided right tail with $\alpha = 0.05$, $z_\alpha = 1.645$.
$z = \frac{3.375-3}{0.96/\sqrt{19}} = \frac{0.375}{0.2202} = 1.703$

$1.703 > 1.645$, so we can say people above 40 suppors BREXIT with 0.95 level of confidence.

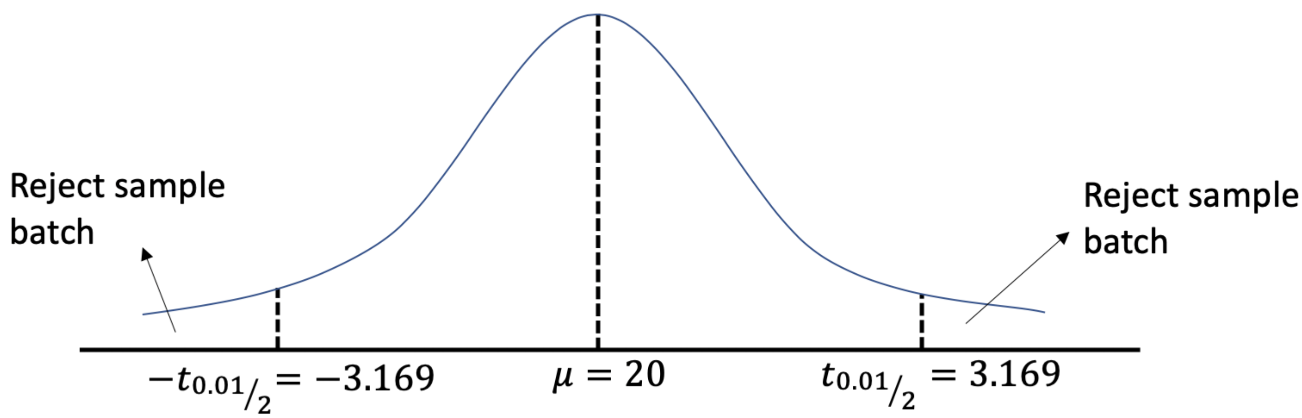
Note 1: t-table can also be used instead of z-table in this question. Thus, those who used t values instead of z values got full points from this question as long as the calculations were correct.
Note 2: Some students solved this question by assuming population variances are equal. These solutions were also accepted as correct as long as the correct formula was used and the calculations were correct.

Q2.

a) $H_0 : \mu = 20.$

b) $H_A : \mu \neq 20.$

c) Degrees of freedom: $11 - 1 = 10.$



$t = \frac{20.07-20}{0.07/\sqrt{11}} = \frac{0.07}{0.07/3.317} = \frac{0.07}{0.0211} = 3.318.$

3.318 is in the rejection region, so the production should be stopped.

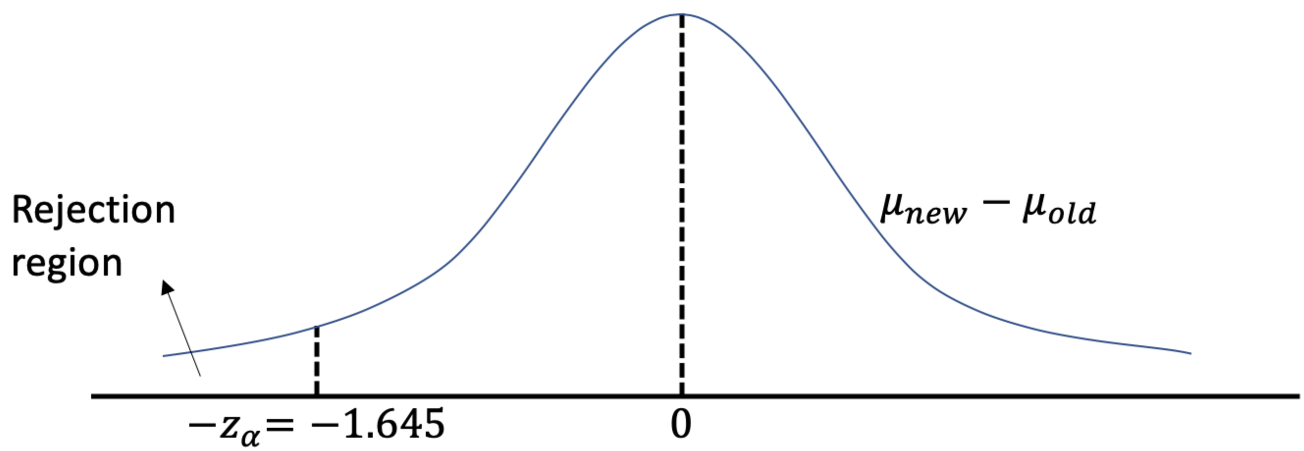
Q3.

a) $H_0 : \mu_{new} = \mu_{old}$ or $\mu_{new} - \mu_{old} = 0$.

b) $H_0 : \mu_{new} < \mu_{old}$ or $\mu_{new} - \mu_{old} < 0$.

c)

One-sided left tail test with $\alpha = 0.05$, $-z_\alpha = -1.645$.



$$z = \frac{2.8-3.0}{\sqrt{\frac{1.7^2}{68}+\frac{1.4^2}{68}}} = \frac{-0.2}{\sqrt{0.0425+0.0288}} = \frac{-0.2}{0.265} = -0.749$$

-0.749 is in the acceptance region. Therefore we cannot reject the null hypothesis which means we do not have sufficient evidence that the new painkillers are better.

Note: Some students solved this question by assuming the population is the products in the market and 3.0 is the population mean. As this issue is not clear in the homework text, this solution was also accepted as long as the calculations were correct.

In this case,

$$z = \frac{2.8-3.0}{1.7/\sqrt{68}} = -0.97$$

Again, -0.97 is in the acceptance region, so we do not have sufficient evidence that the new painkillers are better.